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~~1.~~

(a) heating a mixture of an iodine reagent having at least one iodine end group, a free-radical initiator, and at least one polymerizable monomer, the molar ratio of the free-radical initiator to the reagent being 10 to 0.001, the molar ratio of the monomer to the reagent being 10 to 1000.

(b) converting the iodine end group to the functionalized end group by reaction with a nucleophilic reagent.

3. The process of claim 1 wherein the initiator contains a functional group selected from the group consisting of OR_1 , $\text{N}(\text{R}_1)_2$, SR_1 , COOR_1 , COOM , olefin of the type $-\text{CR}_1=\text{C}(\text{R}_1)_2$,



epoxide of the type $-\text{CR}_1-\text{C}(\text{R}_1)_2$, SO_3M , $\text{PO}(\text{OR}_1)_2$, $\text{PO}(\text{R}_1)_3$, $\text{P}(\text{R}_1)_3$, $-\text{N}=\text{C}=\text{O}$ and $-\text{CR}_1=\text{O}$, wherein R_1 is equal to H or a group having 1-20 carbon atoms, R_1 being the same or different where there is more than one R_1 , and wherein M is a metal ion.

4. The process of claim 2 further comprising the step of (b) isolating any iodine salts produced in step (a) and (c) using said iodine salts in the synthesis of the iodine transfer reagent.

5. The process of claim 1 wherein the iodine reagent is an activated iodine reagent of the formula



where R contains at least one radical stabilizing group and has 1-50 carbon atoms, the iodine and the radical stabilizing group are attached to the

same carbon atom in R, and the radical stabilizing group is selected from the group consisting of an aryl, ester, amide, ketone, nitrile, halogen, and nitro.

6. The process of claim 1 wherein the activated iodine reagent is one selected from the group consisting of iodoacetonitrile, ethyl 1-iodopropionate, 4-methylbenzyl iodide and perfluorohexyl iodide.

7. The process of claim 1 wherein the iodine reagent is a functionalized iodine reagent of the formula



where R contains at least one radical stabilizing group and has 1-50 carbon atoms, the iodine and the radical stabilizing group are attached to the same carbon atom in R, and the radical stabilizing group is selected from the group consisting of an aryl, alkene, ester, acid, amide, ketone, nitrile, halogen, isocyanate, nitro and amine, and

where Z_2 is selected from the group consisting of: OR_1 , $N(R_1)_2$, SR_1 , $COOR_1$, $COOM$, olefin of the type $-CR_1=C(R_1)_2$,

epoxide of the type $-CR_1-C(R_1)_2$, SO_3M , $PO(OR_1)_2$, $PO(R_1)_3$, $P(R_1)_3$, $-N=C=O$ and $-CR_1=O$, wherein R_1 is equal to H or a group having 1-20 carbon atoms, R_1 being the same or different for any Z_2 having more than one R_1 , and wherein M is a metal ion.

8. The process of claim 7 wherein the functionalized iodine reagent is one selected from the group consisting of 2-phenyl-2-iodoethanol, iodoacetic acid and allyl iodide.

9. The process of claim 1 wherein the iodine reagent is an activated di-iodine reagent of the formula



where R contains at least one radical stabilizing group and has 1-50 carbon atoms, the iodine and the radical stabilizing group are attached to the same carbon atom in R, and the radical stabilizing group is selected from the group consisting of an aryl, alkene, ester, acid, amide, ketone, nitrile, halogen, isocyanate, nitro and amine.

10. The process of claim 9 wherein the activated di-iodine reagent is α,α' -diiodoxylene or methyl-2,5-diiodohexanedioate.

11. The process of claim 1 wherein the free-radical initiator is one selected from the group consisting of peroxo compounds having at least one O-O group.

12. The process of claim 1 wherein the free-radical initiator is an azo-initiator selected from the group consisting of azobisisobutyronitrile, azobiscyanovaleric acid, azobis (hydroxethylcyanovaleramide), azobis (cyclohexanecarbonitrile), 2,2' azobis (4-methoxy-2,4-dimethylvaleronitrile), 2,2'-azobis[2-methyl-N-(2-hydroxyethyl)propionamide].

13. The process of claim 1 wherein the monomer is one selected from the group consisting of styrene and substituted derivatives thereof, conjugated dienes and substituted derivatives thereof, acrylates and substituted derivatives thereof, and mixtures thereof.

14. The process of claim 2 wherein the nucleophilic reagent is one selected from the group consisting of mercaptoethanol, thioglycolic acid, mercaptopropanol, thiopropionic acid, allyl mercaptan, and mercaptoethylamine.

15. The process of claim 1 wherein the heating is conducted in a solvent.

16. The process of claim 1 wherein the heating is conducted in bulk.

17. The process of claim 15 wherein the solvent is one selected from the group consisting of toluene, amyl acetate, butyl acetate, pseudocumene, tetrahydrofuran, and dimethyl formamide.

18. The process of claim 15 wherein the solvent is toluene.

19. The process of claim 1 wherein the iodine reagent is preformed or formed *in situ*.

20. The process of claim 1 wherein the polymerizable monomer is added to the mixture simultaneously, sequentially, batchwise or metered.

21. The process of claim 1 wherein the monomer is one selected from the group consisting of styrene and substituted derivatives thereof, conjugated dienes and substituted derivatives thereof, acrylates and substituted derivatives thereof, acrylonitrile, acrylic acid and mixtures thereof.

22. A process for forming a polymer having at least one functionalized end group, the process comprising the step of:

(a) heating a mixture of a functionalized iodine reagent, a free-radical initiator, and at least one polymerizable monomer to form a pre-polymer, the functionalized iodine reagent being of the formula



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$$\text{SR}_1, \text{COOR}_1, \text{COOM}, \text{olefin of the type } -\text{CR}_1=\text{C}(\text{R}_1)_2,$$


-CR₁=O, wherein R₁ is equal to H or a group having 1-20 carbon atoms, R₁ being the same or different for any Z₂ having more than one R₁, and wherein M is a metal ion.

nucleophilic reagent.

iodoacetic acid and allyl iodide.

O-O group.

hydroxyethyl)propionamide].

27. The process of claim 22 wherein the monomer is one selected from the group consisting of styrene and substituted derivatives thereof, conjugated dienes and substituted derivatives thereof, acrylates and substituted derivatives thereof, and mixtures thereof.

28. The process of claim 23 wherein the nucleophilic reagent is one selected from the group consisting of mercaptoethanol, thioglycolic acid, mercaptopropanol, thiopropionic acid, allyl mercaptan, and mercaptoethylamine.

29. The process of claim 22 wherein the heating is conducted in a solvent or in bulk.

30. The process of claim 28 wherein the solvent is one selected from the group consisting of toluene, amyl acetate, butyl acetate, pseudocumene, tetrahydrofuran, and dimethylformamide.

31. The process of claim 29 wherein the solvent is toluene.

32. The process of claim 22 wherein the iodine reagent is preformed or formed *in situ*.

33. The process of claim 22 wherein the polymerizable monomer is added to the mixture simultaneously, sequentially, batchwise or metered.

34. The process of claim 22 wherein the monomer is selected from the group consisting of C₃-C₆ monoethylenically unsaturated carboxylic acids, and the alkaline metal and ammonium salts thereof. The C₃-C₆ monoethylenically unsaturated carboxylic acids include acrylic acid, methacrylic acid, crotonic acid, vinyl acetic acid, maleic acid, fumaric acid and itaconic acid.

35. A process for forming a polymer having at least one functionalized end group, the process comprising the step of:

(a) heating a mixture of an activated iodine reagent, a free-radical initiator, and at least one polymerizable monomer to form a pre-polymer, the activated iodine reagent being of the formula



where R contains at least one radical stabilizing group and has 1-50 carbon atoms, the iodine and the radical stabilizing group are attached to the same carbon atom in R, and the radical stabilizing group is selected from the group consisting of an aryl, ester, amide, ketone, nitrile, halogen, and nitro.

36. The process of claim 35 further comprising the step of:

(b) functionalizing the pre-polymer by reaction with a nucleophilic reagent.

37. The process of claim 35 wherein the activated iodine reagent is one selected from the group consisting of iodoacetonitrile, ethyl 1-iodopropionate, 4-methylbenzyl iodide and 1-iodo-ethylbenzene.

38. The process of claim 35 wherein the free-radical initiator is one selected from the group consisting of hydrogen peroxide, *t*-butyl hydroperoxide, *t*-butyl perbenzoate, *t*-amyl perbenzoate, *t*-butyl peroctoate, *t*-amyl peroctoate, ditertiary butyl peroxide, tertiary-amyl hydroperoxide, dibenzoyl peroxide, potassium persulfate and methyl ethyl ketone peroxide.

39. The process of claim 35 wherein the free-radical initiator is one selected from the group consisting of azobisisobutyronitrile, azobiscyanovaleric acid, azobis (hydroxethylcyanovaleramide), azobis (cyclohexanecarbonitrile), 2,2' azobis (4-methoxy-2,4-dimethylvaleronitrile), 2,2'-azobis[2-methyl-N-(2-hydroxyethyl)propionamide].

40. The process of claim 35 wherein the monomer is one selected from the group consisting of styrene and substituted derivatives thereof, conjugated dienes and substituted derivatives thereof, acrylates and substituted derivatives thereof, acrylonitrile, acrylic acid and mixtures thereof.

41. The process of claim 36 wherein the nucleophilic reagent is one selected from the group consisting of mercaptoethanol, thioglycolic acid, mercaptopropanol, thiopropionic acid, allyl mercaptan, and mercaptoethylamine.

42. The process of claim 35 wherein the heating is conducted in a solvent or in bulk.

43. The process of claim 41 wherein the solvent is one selected from the group consisting of toluene, amyl acetate, butyl acetate, pseudocumene, tetrahydrofuran, and dimethylformamide.

44. The process of claim 42 wherein the solvent is toluene.

45. The process of claim 35 wherein the iodine reagent is preformed or formed *in situ*.

46. The process of claim 35 wherein the polymerizable monomer is added to the mixture simultaneously, sequentially, batchwise or metered.

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51. The process of claim 47 wherein the free-radical initiator is one selected from the group consisting of azobisisobutyronitrile, azobiscyanovaleric acid, azobis (hydroxethylcyanovaleramide), azobiscyanovaleric acid, azobis (hydroxethylcyanovaleramide), azobis (cyclohexanecarbonitrile), 2,2' azobis (4-methoxy-2,4-dimethylvaleronitrile), 2,2'-azobis[2-methyl-N-(2-hydroxyethyl)propionamide].

52. The process of claim 1 wherein the monomer is one selected from the group consisting of styrene and substituted derivatives thereof, conjugated dienes and substituted derivatives thereof, acrylates and substituted derivatives thereof, acrylonitrile, acrylic acid and mixtures thereof.

53. The process of claim 48 wherein the nucleophilic reagent is one selected from the group consisting of mercaptoethanol, thioglycolic acid, mercaptopropanol, thiopropionic acid, allyl mercaptan, and mercaptoethylamine.

54. The process of claim 47 wherein the heating is conducted in a solvent or in bulk.

55. The process of claim 54 wherein the solvent is one selected from the group consisting of toluene, amyl acetate, butyl acetate, pseudocumene, tetrahydrofuran, and dimethylformamide.

56. The process of claim 54 wherein the solvent is toluene.

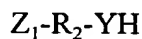
57. The process of claim 47 wherein the iodine reagent is preformed or formed *in situ*.

58. The process of claim 47 wherein the polymerizable monomer is added to the mixture simultaneously, sequentially, batchwise or metered.

59. The process of claim 1 wherein the monomer is one selected from the group consisting of styrene and substituted derivatives thereof, conjugated dienes and substituted derivatives thereof, acrylates and substituted derivatives thereof, acrylonitrile, acrylic acid and mixtures thereof.

60. A process for forming a polymer having at least one functionalized end group, the process comprising the step of:

(a) functionalizing a prepolymer by reaction with a reagent of the formula:



where R_2 is a substituted or unsubstituted alkylidene group having 1-20 carbon atoms or is not present when Z_2 is directly bonded to the polymer,

where Y is selected from the group consisting of oxygen, sulfur, and NR_5 , where R_5 is hydrogen or a substituted or unsubstituted alkyl group or is not present when Z is directly bonded to the polymer, and

where Z_1 is selected from the group consisting of: OR_1 , $N(R_1)_2$, SR_1 , $COOR_1$, $COOM$, olefin of the type $-CR_1=C(R_1)_2$,

epoxide of the type $-CR_1-C(R_1)_2$, SO_3M , $PO(OR_1)_2$, $PO(R_1)_3$, $P(R_1)_3$, $-N=C=O$ and $-CR_1=O$, wherein R_1 is equal to H or a group having 1-20 carbon atoms, R_1 being the same or different for any Z_1 having more than one R_1 , and wherein M is a metal ion.

61. The process of claim 60 wherein the reagent is a sulfur-containing reagent selected from the group consisting of mercaptoethanol, thioglycolic acid, mercaptopropanol, thiopropionic acid, allyl mercaptan, and mercaptoethylamine.

62. The process of claim 60 wherein the step of functionalizing the prepolymer is carried out in solvent or in bulk.

63. The process of claim 62 wherein the solvent is one selected from the group consisting of toluene, amyl acetate, butyl acetate, pseudocumene, tetrahydrofuran, and dimethyl formamide.

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- (a) heating a mixture of an iodine reagent having at least one iodine end group, a free-radical initiator, and at least one polymerizable monomer, the molar ratio of the free-radical initiator to the iodine reagent being 10 to 0.001, the molar ratio of the monomer to the iodine reagent being 10 to 1000; and
- (b) converting the iodine end group to the functionalized end group by reaction with a nucleophilic reagent.

70. The process of claim 69 wherein the monomer is selected from the group consisting of C₃-C₆ monoethylenically unsaturated carboxylic acids, and the alkaline metal and ammonium salts thereof. The C₃-C₆ monoethylenically unsaturated carboxylic acids include acrylic acid, methacrylic acid, crotonic acid, vinyl acetic acid, maleic acid, fumaric acid and itaconic acid.

71. The process of claim 69 wherein the iodine reagent is an activated iodine reagent of the formula



where R contains at least one radical stabilizing group and has 1-50 carbon atoms, the iodine and the radical stabilizing group are attached to the same carbon atom in R, and the radical stabilizing group is selected from the group consisting of an aryl, ester, amide, ketone, nitrile, halogen, and nitro.

72. The process of claim 71 wherein the activated iodine reagent is one selected from the group consisting of iodoacetonitrile, ethyl 1-iodopropionate, 4-methylbenzyl iodide and 1-iodo-ethylbenzene.

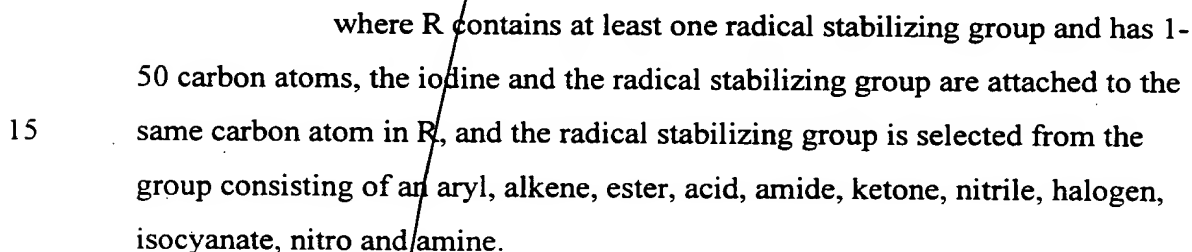
73. The process of claim 69 wherein the iodine reagent is a functionalized iodine reagent of the formula



where R contains at least one radical stabilizing group and has 1-50 carbon atoms, the iodine and the radical stabilizing group are attached to the same carbon atom in R, and the radical stabilizing group is selected from the group consisting of an aryl, alkene, ester, acid, amide, ketone, nitrile, halogen, isocyanate, nitro and amine, and

$$\begin{array}{c} \text{O} \\ \diagup \quad \diagdown \end{array}$$

10 74. The process of claim 69 wherein the iodine reagent is an activated di-iodine reagent of the formula



76. The process of claim 69 wherein the free-radical initiator is one selected from the group consisting of hydrogen peroxide, *t*-butyl hydroperoxide, *t*-butyl perbenzoate, *t*-amyl perbenzoate, *t*-butyl peroctate, *t*-amyl peroctate, ditertiary butyl peroxide, tertiary-amyl hydroperoxide, dibenzoyl peroxide, potassium per sulfate and methyl ethyl ketone peroxide.

77. The process of claim 69 wherein the free-radical initiator is one selected from the group consisting of azobisisobutyronitrile, azobiscyanovaleric

acid, azobis (hydroxethylcyanovaleramide), azobis (cyclohexanecarbonitrile), 2,2' azobis (4-methoxy-2,4-dimethylvaleronitrile), 2,2'-azobis[2-methyl-N-(2-hydroxyethyl)propionamide].

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78. The process of claim 69 wherein the monomer is one selected from the group consisting of styrene and substituted derivatives thereof, conjugated dienes and substituted derivatives thereof, acrylates and substituted derivatives thereof, and mixtures thereof.

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79. The process of claim 69 wherein the nucleophilic reagent is one selected from the group consisting of mercaptoethanol, thioglycolic acid, mercaptopropanol, thiopropionic acid, allyl mercaptan, and mercaptoethylamine.

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80. The process of claim 69 wherein the heating is conducted in a solvent or in bulk.

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81. The process of claim 80 wherein the solvent is one selected from the group consisting of toluene, amyl acetate, butyl acetate, pseudocumene and tetrahydrofuran.

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82. The process of claim 80 wherein the solvent is toluene.

83. The process of claim 69 wherein the iodine reagent is preformed or formed *in situ*.

84. The process of claim 69 wherein the polymerizable monomer is added to the mixture simultaneously, sequentially, batchwise or metered.

~~85.~~ An end-functionalized polymer of the formula



where R contains at least one radical stabilizing group and has 1-50 carbon atoms, the polymer and the radical stabilizing group are attached to the same carbon atom in R, and the radical stabilizing group is selected from the group consisting of an aryl, ester, amide, ketone, nitrile, halogen, and nitro,

where R_2 is a substituted or unsubstituted alkylidene group having 1-20 carbon atoms or is not present when Z_1 is directly bonded to the polymer,

where Y is selected from the group consisting of oxygen, sulfur, and NR₅, where R₅ is hydrogen or a substituted or unsubstituted alkyl group or is not present when Z₁ is directly bonded to the polymer, and

where Z₁ is selected from the group consisting of: OR₁, N(R₁)₂, SR₁, COOR₁, COOM, or olefin of the type -CR₁=C(R₁)₂,

epoxide of the type $-\text{CR}_1-\text{C}(\text{R}_1)_2$, SO_3M , $\text{PO}(\text{OR}_1)_2$, $\text{PO}(\text{R}_1)_3$, $\text{P}(\text{R}_1)_3$, $-\text{N}=\text{C}=\text{O}$ and $-\text{CR}_1=\text{O}$, wherein R_1 is equal to H or a group having 1-20 carbon atoms, R_1 being the same or different for any Z_1 having more than one R_1 , and wherein M is a metal ion.

86. The polymer of claim 85 wherein R₁ is selected from the group consisting of acetonitrile, 4-methyl benzyl, perfluorohexyl, and ethyl 1-propionate.

87. The polymer of claim 85 wherein R₂ is selected from the group consisting of methylene, ethylidene, and propylidene.

88. The polymer of claim 85 wherein "polymer" is selected from the group consisting of poly(n-butyl acrylate), polystyrene, poly(ethyl acrylate), poly(ethylhexyl acrylate), and poly(acrylonitrile-co-n-butyl acrylate).

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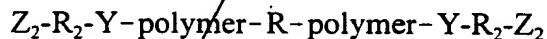
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92. The polymer of claim 90 wherein R₂ is selected from the group consisting of methylene, ethylidene, and propylidene.

93. The polymer of claim 90 wherein "polymer" is selected from the group consisting of poly(n-butyl acrylate), polystyrene, poly(ethyl acrylate), poly(ethylhexyl acrylate), and poly(acrylonitrile-co-n-butyl acrylate).

94. The polymer of claim 90 wherein Z_1 and Z_2 are independently selected from the group consisting of OH, COOH, NH_2 , $CH=CH_2$.

95. An end-functionalized polymer of the formula



where R contains at least one radical stabilizing group and has 1-50 carbon atoms; the polymer and the radical stabilizing group are attached to the same carbon atom in R, and the radical stabilizing group is selected from the group consisting of an aryl, alkene, ester, acid, amide, ketone, nitrile, halogen, isocyanate, nitro and amine,

where R_2 is a substituted or unsubstituted alkylidene group having 1-20 carbon atoms or is not present when Z_2 is directly bonded to the polymer,

where Y is selected from the group consisting of oxygen, sulfur, and NR_5 , where R_5 is hydrogen or a substituted or unsubstituted alkyl group or is not present when Z is directly bonded to the polymer, and

where Z_2 is selected from the group consisting of: OR_1 , $N(R_1)_2$, SR_1 , $COOR_1$, $COOM$, olefin of the type $-CR_1=C(R_1)_2$,

epoxide of the type $-CR_1-C(R_1)_2$, SO_3M , $PO(OR_1)_2$, $PO(R_1)_3$, $P(R_1)_3$, $-N=C=O$ and $-CR_1=O$, wherein R_1 is equal to H or a group having 1-20 carbon atoms, R_1 being the same or different for any Z_2 having more than one R_1 , and wherein M is a metal ion.

96. The polymer of claim 95 wherein R is xylylene or methyl 2,5-hexanedioate.

97. The polymer of claim 95 wherein R_2 is selected from the group consisting of methylene, ethylidene, and propylidene.

98. The polymer of claim 95 wherein said radical stabilizing group is selected from the group consisting of C_6H_5 , CN, $COOCH_2CH_3$, $COOCH_2CH_2CH_2CH_3$, OCH_2CH_3 , Cl, F and COOH.

99. The polymer of claim 96 wherein Z_2 is selected from the group consisting of OH, COOH, NH_2 , $CH=CH_2$.

100. The polymer of claim 95 wherein "polymer" is selected from the group consisting of poly(n-butyl acrylate), polystyrene, poly(ethyl acrylate), poly(ethylhexyl acrylate), and poly(acrylonitrile-co-n-butyl acrylate).

101. A polymer selected from the group consisting of polyurethanes, polyesters, polyamides, polycarbonates, and polyepoxides made by further polymerizing the polymer made by the process of claim 1.

102. The polymer of claim 101 wherein the polymer is a polyurethane having improved hydrolytic stability and ultraviolet light stability.

103. A polymer selected from the group consisting of polyurethanes, polyesters, polyamides, polycarbonates, and polyepoxides made by further polymerizing the polymer of claim 85.

104. The polymer of claim 103 wherein the polymer is a polyurethane having improved hydrolytic stability and ultraviolet light stability.

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